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Report for an
“Interactive System that will encourage the use of public transportation”

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1. Data Gathering

This section of the report aims to briefly describe the results of the survey.

1.1 Data Gathering

A survey/questionnaire is used to gather quantitative and qualitative data as the main data gathering method. According to Preece, Rogers, Sharp [1] “questionnaires can reach many people with low resource and are good for answering specific questions, but the response rate may be low and the responses given may not be what you want, the design and questions are crucial.”

1.1.1 Survey Results

49 answers, through online survey, distributed by email and social networks.

Age distribution & Occupation

Most answers of our survey came from the age group of 21-30, all other age groups fall behind by a big margin. (see Figure 1.1). The majority of the respondents are undergraduate or postgraduate.

Air Pollution & Global Warming

According to the data (see Figure 1.2), air pollution and its contribution to global warming bothers most of the people.

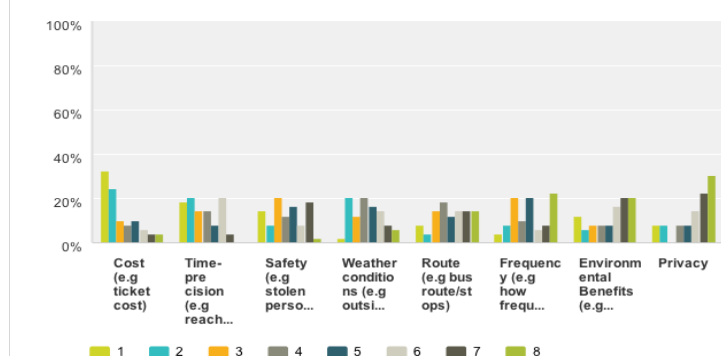
Preferred ways of buying public transportation tickets

In figure 1.3, there is a preference to buy tickets directly from the driver or use a prepaid transportation card while using the internet to order tickets is falling behind by approx 10%.

Attributes that dictate the choice of transportation

Cost & time seems to be the most important factor in dictating the choice of transportation, cost is slightly higher. While safety, weather conditions, route and frequency come after with a small margin in-between them. Environmental benefits and privacy come last.

Figure 1.1 – Survey “Rate the following factors (in order of importance for you) in dictating your choice of transport?” question.



Summary of respondent's

opinion on what incentives would motivate them to use public transportation instead of a car.

The majority of the answers mentioned about cost, time, frequency, not trustworthy public transportation, bad scheduling.

Summary of respondent's opinion on what improvements would they recommend for public transportation.

Most respondents recommend improvement to frequency, scheduling and timing of public transportation and some of them also recommend an application or an Information System as a way to improve accuracy and address scheduling issues.

2. User Requirements & Scenario Based Design

This section of the report defines the user requirements by the use of scenarios.

2.1 Personas

Thomas Crown is a 54 year old business man who owns a pizza hut located in the central part of Leeds. He lives a quiet life and focuses most of his attention on learning to run his business more efficiently. He spends his free time taking online courses on effective business management with his PC. Thomas owns a smart phone although he is not very tech savvy. He understands the basics of mobile apps such as Gmail which he uses regularly to read his emails respectively. Sometimes when Thomas is idle, he experiments with the various apps in his telephone. He understands the power of using technology to expand the reach of his business that is why he subscribes to online advertising services. Thomas believes that time is money; he realizes the importance of effective planning, time management and customer satisfaction in running his business, so he gets very irritated when any service to be rendered to him is delayed for any reason. Thomas owns a blue car, which he uses mostly to move around town in order to carry out daily activities. Being a businessman, he believes in the core idea of timely delivery of service, cost reduction to the barest minimum, so he is open to any idea that will help him efficiently run his business at minimum cost, but still give quality and timely service to his customers.

Elizabeth Olsen is a 23 year old student of the University of York. She currently is studying a master's degree program in the department of economics. She lives off campus, in the City Centre of York. Every morning on a school day, she walks quite a distance to the bus stop from where she takes a bus to the university to attend the classes scheduled for the day. She's a very social girl who loves to keep in touch with her friends regularly and make new friends. She owns an apple smart phone which she uses to communicate with her friends and keep up with the latest trends in fashion by visiting fashion websites. Whenever Elizabeth has some free time between lectures, she chats with her friends using the various social apps (Facebook, Twitter, Instagram) she installed in her phone. After a hectic day in school, Elizabeth takes the bus back home. She dislikes the fact that she has to wait for quite some time before the next bus that takes her to her destination arrives. She gets further aggravated if the bus delays in arriving. Elizabeth is of the opinion that using the bus is expensive, nonetheless she uses it because she is uncomfortable with alternatives such as bicycle, walking and she can't afford a car.

2.1.1 Goals

Thomas

1. Get to work place on time and carry out daily duties on schedule.
2. Waste as less as possible money on daily activities.
3. Move around town without worrying about safety of personal belongings.

Elizabeth

1. Get to school on time for lectures.
2. Pay less money on transportation.
3. Get to the bus stop from home in the shortest possible time and from bus stop to home in the shortest possible time.

2.2 Problem Scenario

The problem scenario is based on Thomas Crown persona.

Thomas Crown, a 54 year old man from Leeds, drives to his pizza hut every morning to carry out business for the day. His car developed problems yesterday, so he decides to use public transportation. While having breakfast, he searches the internet with his PC for the closest bus stop to his home where he can get a bus that'll take a direct route that leads to his business place. He finds 3 bus stops, but he couldn't accurately tell which is closest. Therefore, he randomly picks one bus and heads for the bus stop by foot. On arriving at the bus stop, he reads the bus time table and realizes that he arrived just 1 min before the arrival of the next bus. But 10 min later he's still waiting, anxiety sets in.

When the bus finally arrived, he asked the driver the cost of the bus ticket. Being a shrewd business man, he got off the bus when he was told the price because it occurred to him that using another bus may be cheaper. When the bus stopped at Thomas' destination, he quickly came down from the bus and walked as quickly as he could so as to open his business place.

At 10pm, Thomas locks up his store, carries his bag and heads to the bus stop to catch a bus takes a direct route leading to his home. On reaching the bus stop, he reads the bus time table and realizes that next bus is scheduled to arrive in 30min. This makes him unhappy. As he waits for the direct bus, another bus arrive the bus stop. This leaves Thomas contemplating between two choices. Wait 30 min for the bus that takes a direct route leading to his home or to take the bus currently in the bus stop, although this will mean he will have to combine various buses to get home. But since he can't tell which the quicker choice is or which choice is more expensive, it was difficult for him to reach a decision. Thomas finally decides to wait 30 minutes since he was not in a hurry to get home and he assumed that the direct bus will be the cheaper option.

2.2.1 Claims Analysis

The claims analysis for the problem scenario.

Expensive bus fares
+ It'll lead to less crowded buses as less people will be willing to pay the fare.
+ It'll provide better public transport facilities.
- It'll decrease customers of bus/bus usage.
- It'll discourage people from using the bus.

Bus time table doesn't always reflect the actual time of arrival of buses at the bus stop.
+ People that don't arrive the bus stop on time may still be catch the bus if the bus delays.
- People will not be able to make precise plans based on the bus time table.
- People may arrive late to their destination.

Forgetting valuable personal belongings in the bus.
- Low chances of recovering valuable personal belonging that was forgotten in a bus.
- The public transport need to provide extra efforts to help finding losing things.

Bus stops are not always close to people's destination.

+ People that love to walk will see it as an opportunity to exercise.
- People have to walk some distance from the bus stop to get to their destination.

Low frequency of arrival of buses at the bus stop.
+ The bus company can save costs.
- It makes it difficult for people to respond to emergency situations using a bus.
- People with tight schedule will arrive late to their destination.

2.3 User Requirements

In this section the user requirements are explicitly defined based on the personas and the Thomas Crown problem scenario. According to the data gathered by the survey and the assumptions of the scenarios aforementioned we have concluded to several major “deciding” factors that can encourage the use of public transportation, which are:

Time, Frequency, Cost and Safety.

Requirements

- The user wants to be able to have access to a precise live status of buses arrival and departure from each bus stop.
- Be able to browse through bus stops around him using a map and find the schedule related of each bus stop.
- Get the cheapest bus trips to his/her destination using more than 1 bus or only 1 bus.
- Find the fastest way to get to his/her destination using more than 1 bus or only 1 bus.
- Have some kind of a safety functionality for his own personal items. e.g bag.

All requirements aforementioned satisfy directly or indirectly the factors above.

2.4 Interactive System Functionality

Our interactive system will have the following base functionalities according to User Requirements:

- Search bus route. (By quickest time to reach destination or by cheapest cost)
- Show bus stops near you. (Using the GPS service and through these bus stops find the bus trips he's interested in)
- Quickest path. (Gives direction, the shortest path to walk to a destination)
- Luggage Reminder. (The user can choose to be alerted on reaching a destination)

2.5 Activity Scenario

The activity scenario is based on the Thomas Crown's problem scenario.

Thomas' car is in need of repairs, so this morning he decides to go to his pizza hut by means of public transportation. The next morning, he launches the app on his mobile phone to find the bus stop closest to his home and how long it'll take him to walk down to the bus stop, the app did a search for the nearest bus stops based on the GPS location of his phone. He then gets his work bag ready and heads for the bus stop. He has an

appointment at 8:15 at his pizza hat.

While at the bus stop he checks the app for the real-time position and estimated time of arrival of the buses that will arrive at the bus stop within 20min. From the result of his query, he realized that the bus taking a direct route to his destination was due to arrive in 12mins but a bus that would take a detour en route to his destination was due to arrive in 45 seconds. This troubled him because the time was 7:45 and a bus journey to his business place takes about 25min. So he decided to do a “get there fast” search on the xxx application. To his surprise, the result revealed that although he will make 2 stops in the process, if he took the approaching bus he will get to his destination 5 minutes earlier compared to a situation where he waits for the bus that’ll take a direct route to his destination. With no time to spare, Thomas quickly made his way into the bus as soon as it stopped at the bus stop.

At the end of the business day, Thomas decided to search for a cheap means of getting to his destination by bus using the app. He selected the “Best Bargain” feature, this revealed to him that he could pay less for his journey home if he took the bus YYY, instead of the bus ZZZ which will arrive the bus stop 30min earlier than bus YYY. With his mind made up to join the cheaper bus, Thomas sits back in his chair and lets the time pass.

On arrival of bus YYY, Thomas enters the bus and drops his bag on the floor. As the bus reaches the desired destination, Thomas walks heads to the exit, app on his mobile phone set off a beeping sound. It suddenly occurred to Thomas that he forgot his bag on the floor. Immediately, he rushed to where his bag was, picked it up and left the bus praising his decision to enable the “Luggage reminder” alarm function in the xxx application.

2.4.1 Claims Analysis

The claims analysis for the activity scenario.

Provide comparison of bus fares from different buses heading to the same destination from the same bus stop.
+ The user can save cost by comparing the price.
- Some buses are overcrowded, while some are lack of passages.
Determine the real-time location of a bus and the time span towards arrival to the stop.
+ It helps the user to choose routes.
+ The user can save time to do finish other activities rather than waiting at the bus stop.
- Traffic jam can cause reliability issues.
Remind people to check their personal belongings before leaving the bus.
+ The user can be more relaxed from worrying about forgetting personal belongings.
+ It helps to reduce the rate of losing goods when taking public transports.
- The user needs to set this function every time when they make a route.
- Some might get irritated.
For routes not taken by buses, we determine the shortest path to a destination.
+ It helps the user to save time and do less effort.
+ Help them find a bus stop near them.
Provide a means to determine the fastest way to reach a destination.
+The user can compare directly between waiting for a direct bus or combining buses

to get to a destination.
+It provides the results in ranking reducing the burden of reading.

3. Prototype

Our interactive system is a real-time GPS based mobile application. The application can monitor in real-time, the distance and amount of time it will take a bus to arrive at a bus stop, more specifically it helps the user:

- Find a bus stop to take a bus from, based on proximity to the users current location.
- Find a path to walk to a destination from the users current location.
- Find which bus to take in a bus stop, based on certain criteria such as cost of bus fare or urgency of user to get to his destination.

Additionally, the application provides a function which helps the user to ensure safety of personal belonging which sets off a reminding alert sound on every stop.

3.1 Goals & Requirements Satisfaction

Goals – Thomas

- Get to work place on time and carry out daily duties on schedule.
 - Using the precise real time bus stop around the user monitoring functionality.
 - Search for bus trips functionality.
 - Find non bus routes functionality.
- Waste as less as possible money on daily activities
 - Using the best bargain functionality to find cheapest buses.
- Move around town without worrying about safety of personal belongings.
 - Using the luggage reminder feature to be reminded to ensure the user is in possession of his personal belongings before exiting the bus at a bus stop.

Goals – Elizabeth

- Get to school on time for lectures.
 - Using the precise real time bus stop around the user monitoring functionality.
 - Search for bus trips functionality.
 - Find non bus routes functionality.
- Pay less money on transportation.
 - Using the best bargain/find cheapest buses functionality.
- Get to the bus stop from home in the shortest possible time and from bus stop to home in the shortest possible time.
 - Use of the fastest route to destination/search based on urgency functionality.

User Requirements

- The user wants to be able to have access to a precise live status of buses arrival and departure from each bus stop.
 - Using the precise real time bus stop around the user monitoring functionality.
- Be able to browse through bus stops around him and find fast the scheduling related to each bus stop.
 - Using the precise real time bus stop around the user monitoring functionality.

- Get the cheapest bus trips to his destination.
 - Using the best bargain/find cheapest buses functionality.
- Find the fastest way to get to his/her destination using more than 1 bus or only 1 bus.
 - Use of the fastest route to destination/search based on urgency functionality.
- Have some kind of a safety functionality for his own personal items. e.g bag.
 - Using the luggage reminder feature to be reminded to ensure the user is in possession of his personal belongings before exiting the bus at a bus stop.

3.2 Functionality Description

The description of 2 complex functionalities (see Figures in Appendix A for the full prototype design).

Search bus route (By quickest time)

This functionality makes the user know the quickest means of getting to a destination bus stop, from a take-off bus stop supplied by the user. In a situation where the bus that can take the user directly to his destination bus stop is yet to arrive, a bus that will take a detour en-route to the users destination are close by, this functionality will analyse the time it will take the user to get to his destination by combining the approaching bus with other buses before getting the user to his destination bus stop. If such bus combination gets the user to his destination earlier than the bus heading directly to the destination, the user is better off getting to his destination by combining buses.

Thomas Crown is a man who values time and dislikes time wasting. Based on the problem scenario of Thomas Crown, he didn't know of a quicker way to get to his destination, so he had to wait for more than 10 minutes before the bus taking a direct route to his destination arrived.

From the activity scenario of Thomas crown, once he realized that the bus that'll take him directly to his destination wasn't due to arrive to the bus stop till 20min, he immediately used this functionality of the xxx application to see the alternatives available to him. As a result, he was able to get to his business place just in time for his appointment.

This functionality will also be helpful to Elizabeth Olsen. In a situation where she is already late for school and the bus that takes her directly to school is not forthcoming, she will use this functionality of the application to see the quickest means of getting to school. There may be a way to combine buses and still get to school quicker instead of waiting. (see Figures 2.7, 2.8, 2.9 in Appendix A)

Show bus stops near you

The functionality gives the user information about the bus stops that are near his current location and it lets him. (see Figure 1.2) The application uses the GPS co-ordinate of the smart phone to determine the location of the user. It then uses the GPS location of various bus stops that are near the user to provide a real-time map display of the user's position and the position of the bus stops near him. Also this functionality determines the bus stop closest to the user and places this bus stop at the top of the list that shows the bus stops close to the user. This functionality reduces to the minimum the distance the user will walk to get to a bus stop by indicating the closest bus stop.

Thomas Crown is a time conscious man who normally moves with his car. Based on the

problem scenario of Thomas Crown, his car has developed some fault, so he decides to use public transportation. He is in a hurry to meet up with an appointment, but he can't tell which bus stop is closest to his home. This made him randomly pick a bus stop to walk to. From the activity scenario of Thomas Crown, he used the xxx application to find the bus stop closest to him. This gave him information of bus stop and also the estimated time to get to the bus stop on foot. As a result, he was able to save time that would otherwise have been spent walking to a further away bus stop. (see Figures 2.1, 2.2, 2.3 in Appendix A)

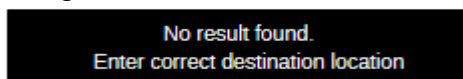
3.3 Design Considerations

Using the Shneiderman's [2] and Don Norman's [3] principles.

3.3.1 Search bus route

Offer informative feedback (Shneiderman).


- If a successful search is done, the system gives sound feedback at the same time it displays the result of the search.
- If a search is unsuccessful, for example an invalid location is typed in one of the search text field, the system gives sound feedback at the same time it displays dialog box that reads "No result found, enter correct destination location".



- Also user feedback is also given by changing the background of a control component (button or list button) when the control is pressed.




Permit easy reversal of actions (Shneiderman).

- We used an android phone for our prototype. Android phones already have buttons for "Back" . Thus in order to support aesthetic and minimalistic design, the already available buttons will be used by the user for easy reversal of actions. The "back" button gives the an escape key for situations when the user is stuck and wants to reverse his action or escape to part of the application he is comfortable with.
- But if the design is for another platform like the i-phone, we will buttons for "back".

Reduce short-term memory load (Shneiderman).

- When the user starts typing in a location in a text field, we minimise memory load of the user, and support recognition rather than recall by providing a history of past input that matches the input the user is currently typing. In a case where the user wants to search a previously searched location, the user can select the location from the list, instead of re-typing.

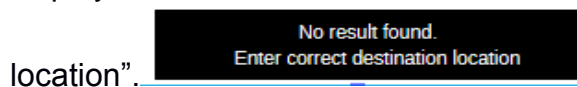
Visibility (Norman).

- Our design makes this functionality and all other relevant features of the application easily accessible. The menu bar  that links to all the functionalities is available on every page of the application. This makes it very easy for the user to access any functionality he desires to use.

- When the application is started, the “BUS STOPS NEAR YOU” functionality is executed. This immediately makes the functionality known to the user.

Offer simple error handling (Shneiderman).

- Our design helps prevent error when the user types in the search text field by providing the user assistance such as:
 - 1 Spell check during typing.
 - 2 Provide a list history of past input that matches the input the user is currently typing. In a case where the user wants to search a previously searched location, the user can select the location from the list, instead of re-typing.
- If a search error is made, for example an invalid location is typed in one of the search text field, a dialog that contains an error message which clearly explains in non-technical terms what error occurred and how to correct the problem is displayed - “No result found, enter correct destination




location”.

Enable frequent users to use shortcuts (Shneiderman).


- Our design provides a search icon on all pages so that a new search can be made at any time without having to use the “back” button to return to the page where the previous search was made. This will reduce the number of interactions the user will have to make in order to access a search function. Thus increasing the pace of using the application.
- Our application provides the “Use current location” check box ☐ Use current location which automatically uses the users the current location as the take-off location during a search. This prevents the user from typing a location, thus reducing the number of interactions and increasing the pace at which the application is used.

3.3.2 Search bus Stops Near you

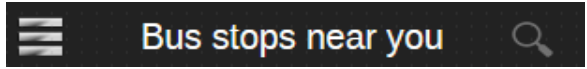
Visibility (Norman)

- Our design gives visibility to this feature by executing the functionality at start of the application. This immediately makes the functionality known to the user. Also, the menu bar  that links to all the functionalities is available on every page of the application. This makes it very easy for the user to access any functionality he desires to use.

Affordance – Properties of an object that determine how the object could be used. (Norman)

- Our design uses the concept of affordance by using image buttons that give a visual cue of how to use it and functionality that would be available to the user when he uses it. The image button  gives a clue that a search will be done by tapping the image button.

Feedback (Norman)


- The design includes a title bar  that informs the user of the functionality he has selected. This also helps reduce the memory

load from the user as he doesn't have to keep mental track the part of the application he is currently in. The user can always get this information from the title bar.

- Also user feedback is also given by changing the background of a control component (button or list button) when the control is




pressed.

- The design for this functionality specifies that objects in motion in the map are shown as blinking icons. A bus in motion in the map will be shown with a blinking bus icon  on a map.

Mapping (Norman).

- The design specifies that real-time movement of the user and buses in the real world should be reflected in the application by corresponding movement of the icon that represents the user location and bus locations on the map.

Permit easy reversal of actions (Shneiderman).

- We used an android phone for our prototype. Android phones already have buttons for “Back” . Thus in order to support aesthetic and minimalistic design, the already available buttons will be used by the user for easy reversal of actions. The “back” button gives the an escape key for situations when the user is stuck and wants to reverse his action or escape to part of the application he is comfortable with.
- But if the design is for another platform like the i-phone, we will buttons for “back”.

4. Expert Evaluation

In this section of the report, we are presenting the CHE evaluation, usability problems and prototype refinements undertaken. The evaluation was made using the J. Nielsen Heuristics [4].

(see Appendix D for Heuristic problems list).

4.1 Evaluation Methodology

The methodology we used in implementing the expert evaluation is the Collaborative Heuristic Evaluation (CHE). We worked together in picking out the potential usability problems of the system. Each person stated the problem he/she noticed with the system and it problem was written down in a list. Each group member independently evaluated and rated each problem on the list using a scale of 0 – 4 (0: not a usability problem, 1: Cosmetic problem, 2: Minor problem, 3: Major problem, 4: Catastrophic problem). From the individual rating of each problem, we obtained the average rating for each problem on the list. The average rating helped to provide a priority list as to which problems need urgent attention.

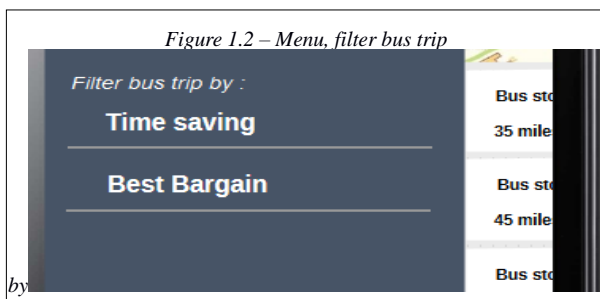
4.2 Functionality Redesign

Search Functionality:

The search functionality is very critical to the user. This is because from the activity scenario, it is the functionality that offers a solution to the problem of cost. The search functionality also offers a solution to the problem of buses not low frequency of arrival of buses at the bus stop. From the severity rating of the expert evaluation, problems found within the search functionality have a very high severity rating. Thus the search functionality has been chosen as the functionality with usability problem.

(See Figures in Appendix B for the full re-design)

4.3 Usability Problems & Fixes



what we wanted:

We wanted the functions (time saving and best bargain) to be visible. [Don Norman – visibility].

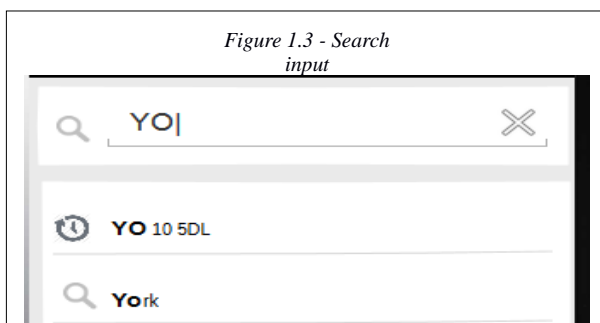
What heuristic we violated(see figure 2.4, Appendix A):

Match between system and the real world. It broke the concept familiar to users. Users

normally filter a search.

How we fixed it:

We made it in context of a search (filtering based on a search). (See Figures 3.2, 3.4 from Appendix B)



What we wanted:

We used only text field to accept input from users as most users are familiar with the idea of forms. This decision to use forms was influenced by the design principle of affordance.

What heuristic we violated (See Figure 2.9, Appendix A):

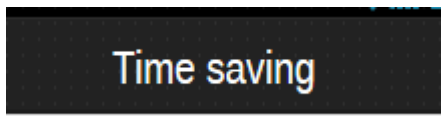
Recognition rather than recall. It did not fully

minimize the users memory load. Even though it offered spell check and provided history inputs.

How we fixed it:

When the user types in a location/post code, the redesign provides a list of bus stops within that area so that the user can select the desired one. This minimizes memory load as the user doesn't have to know the exact address of the desired bus stop. This also prevents a situation where the system selects a bus stop not desirable to the user. (see

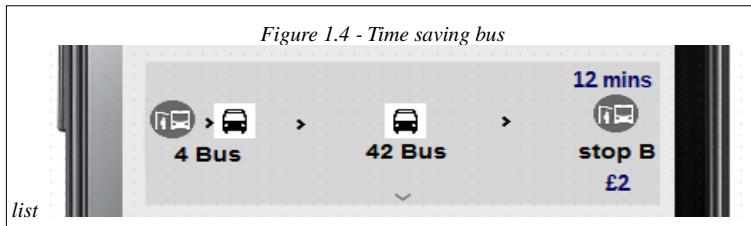
Figure 3.5 from Appendix B)



What heuristic we violated (see Figure 2.7 from Appendix A): The use of the word “Time saving” violates the heuristics of consistency and standards which forbids the use of ambiguous words which have many meaning.

How we fixed it:

We used the descriptive phrase “quickest to destination”. (see Figure 3.6 from Appendix B)



What we wanted:

To show a list of bus trips ordered by the quickest bus to get to the destination.

What heuristic we violated (see Figure 2.7 from Appendix A):

Aesthetic and minimalist design. The view is confusing and overcrowded.

How we fixed it:

Using a simple self-explanatory design. (see Figure 3.6 from Appendix B)

5. User Evaluation

In this section of the report, we are presenting the User evaluation findings, problems and prototype refinements undertaken.

(see Appendix E for user problems)

5.1 User Evaluation Methodology

The methodology used in carrying out the user evaluation is the task based user evaluation. A total of 8 individuals were used in the user evaluation. We gave each individual a task to perform with our interactive system. We asked them to work naturally with the system while saying out the difficulties they experience as they walk through the different parts of the system. We take notes of the problem the user experience as he/she uses the application. At the end of the evaluation, we rate the problems encountered by the user using a scale of 0 – 4 (0: not a usability problem, 1: Cosmetic problem, 2: Minor problem, 3: Major problem, 4: Catastrophic problem). We then combine the ratings by taking an average of the rating. The average rating helped to provide a priority list as to which problems need urgent attention.

5.2 Functionality Redesign

Show “Bus Stops Near You”:

The functionality “Bus Stops Near You” is very critical part of the application to the user. This is because from the activity scenario, it is a functionality that affords the user to see

on a real-time map his position and the position of bus stops near the user, with information of the distance of a bus stop from the user and an estimated amount of time it'll take the user to walk to the bus stop. This functionality allows the user to make a selection of bus stop which will provide in real-time the map position and information of buses that will approach the bus stop within a set time of 20 minutes. This functionality also provides the details of bus stops that a selected bus will stop at. The "Bus Stop Near You" functionality solves some of the problem in the problem scenario of the report, thus justifying its importance to the user.

(see Appendix C for the full redesign of this functionality)

5.3 Usability Problems & Fixes

Usability Problems

1. The list items don't look like buttons that should be clicked. (see Figure 2.1 in Appendix A)
2. The icon that represents the current position of the user is not self explanatory(see Figure 2.1 in Appendix A).
3. This function is executed at the start of the application. It causes Information over flood at start of application. (see Figure 2.1 in Appendix A).
4. The map of Figure 2.3 (see Figure 2.3 in Appendix A) is not self-explanatory. Use of icons to represent bus stops and buses that is not consistent with the icons that represent bus stops and buses in other parts of the application .

Fixes & Re-design

Using the Shneiderman's [2] and Don Norman's [3] principles.

1. The re-design for this functionality is influenced by Don Normans principle of affordance. We use a component that gives a visual cue of how to use it. (i.e. it should be clicked). (see Figure 4.3 in Appendix C).
2. The re-design involved using a consistent icon throughout the application to represent the current position of the user. This follows Shneiderman's principle of "strive for consistency". Another part of the re-design also involves giving informative feedback of the which icon represents the user. This follows Shneiderman's principle of informative feedback. (see Figure 4.1 in Appendix C).
3. Influenced by the Nielsen's heuristic of aesthetic and minimalist design, we re-designed the start-up of the application to show only the current location of the user on a map. This prevents over flooding the user at start of the application. (see Figure 4.1 in Appendix C).

4. The re-design involved using a consistent icon throughout the application to represent the current position of the user. This follows Shneiderman's principle of "strive for consistency". (see Figure 4.1 in Appendix C).

References

- [1] J. Preece, Y. Rogers, H. Sharp. "Interaction Design beyond Human-Computer interaction". USA. John Wiley & Sons inc. 2002.
- [2] B. Schneiderman. "The eight golden rules of interface design". Internet: <http://www.cs.umd.edu/~ben/goldenrules.html> Date accessed: 15/Jan/2014.
- [3] D. A. Norman. "The Design of Everyday Things". USA : New York. Basic Books. 1988.
- [4] J. Nielsen. "10 Usability Heuristics for User Interface Design". Internet: <http://www.nngroup.com/articles/ten-usability-heuristics/> Date accessed: 15/Jan/2014.

Appendix A: Prototype screenshots

Figure 2.1

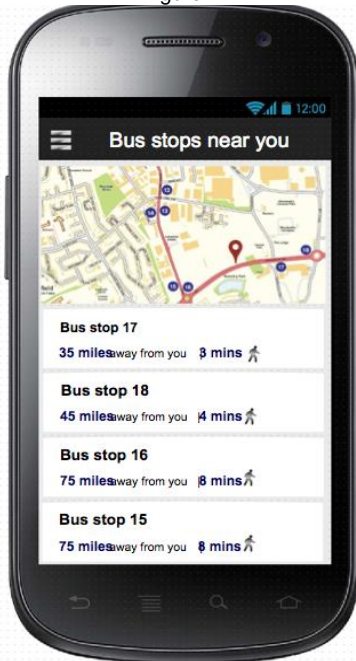


Figure 2.2



Figure 2.3

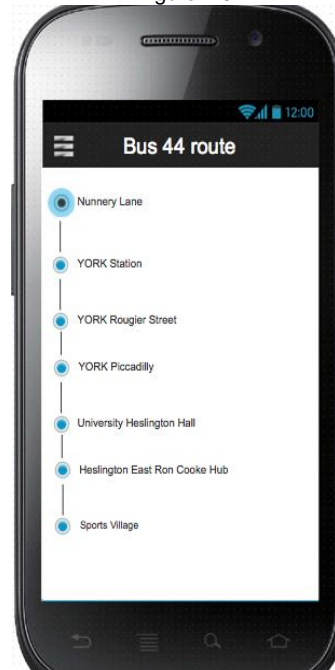


Figure 2.4

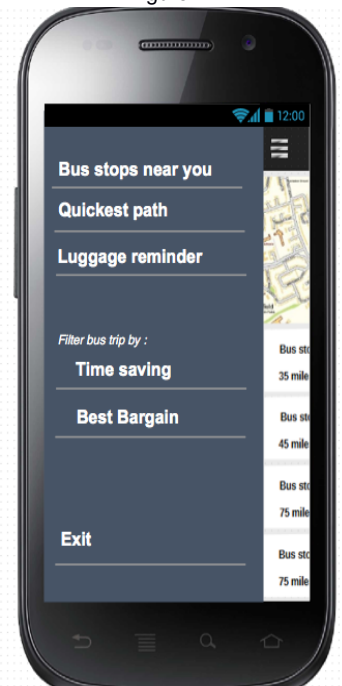


Figure 2.5



Figure 2.6



Figure 2.7

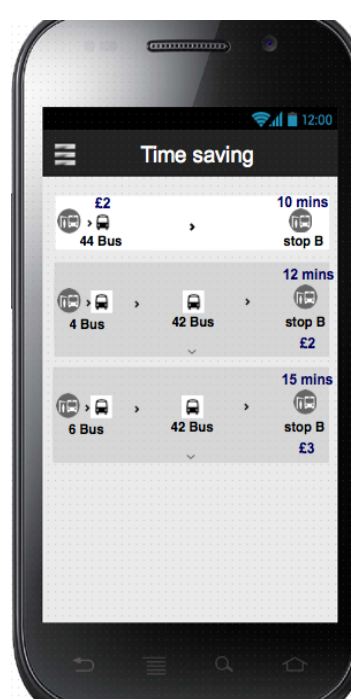


Figure 2.8

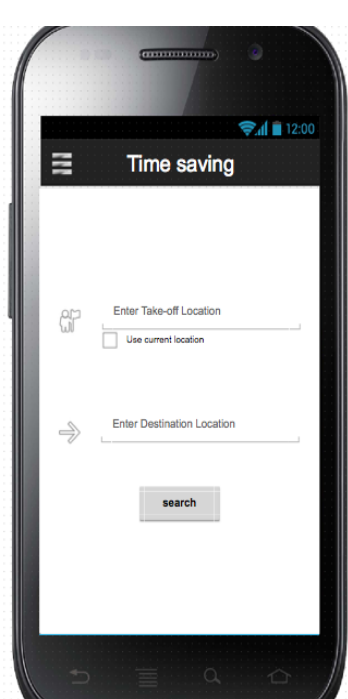


Figure 2.9

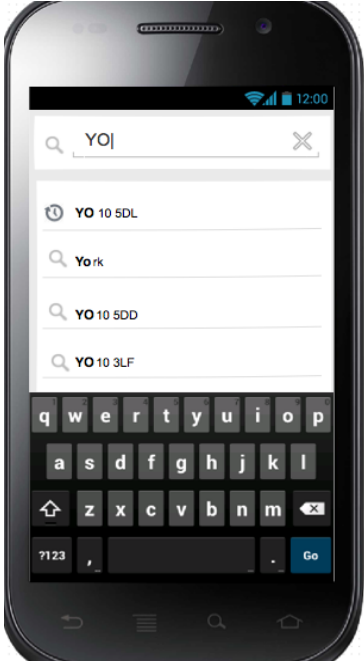


Figure 2.10

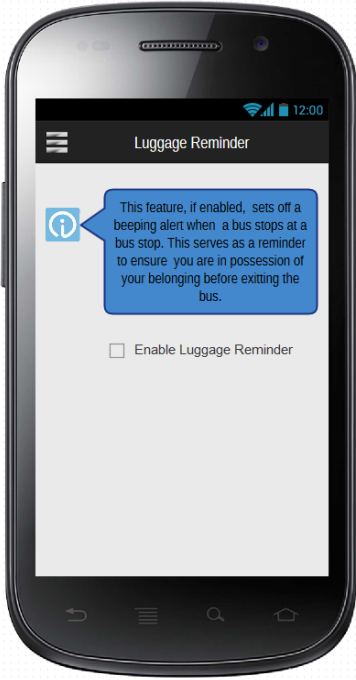
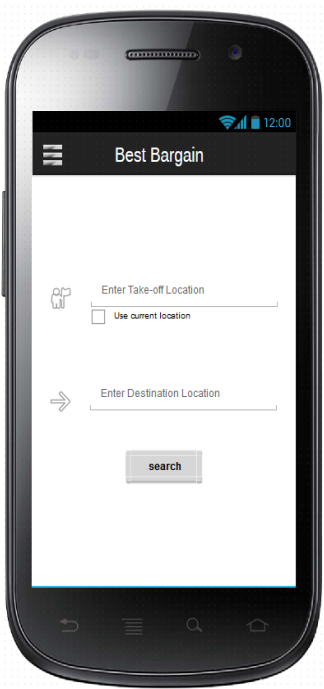


Figure 2.11



Figure 2.12



Appendix B: Expert Evaluation Refinement Screenshots

Figure 3.1

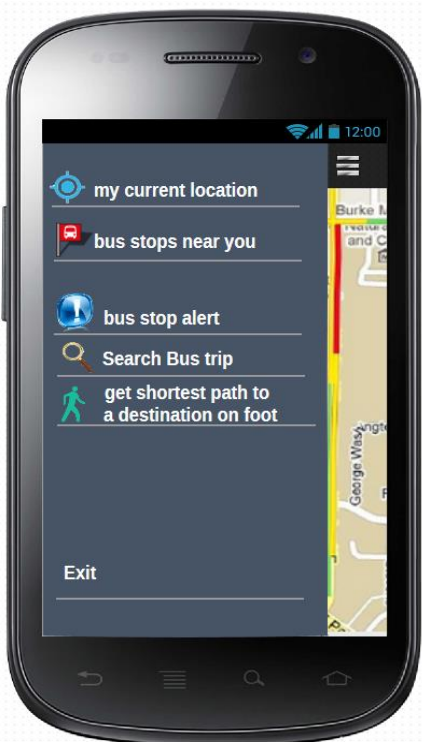


Figure 3.2

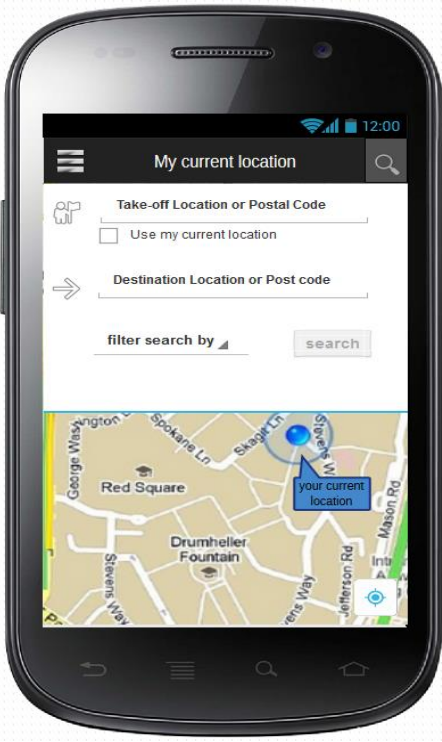


Figure 3.3

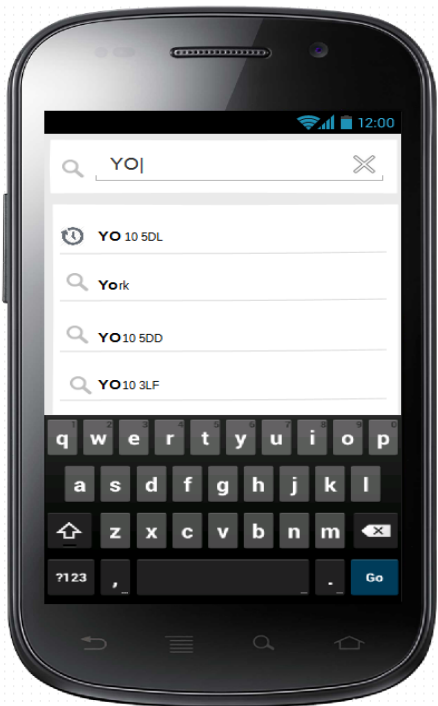


Figure 3.4

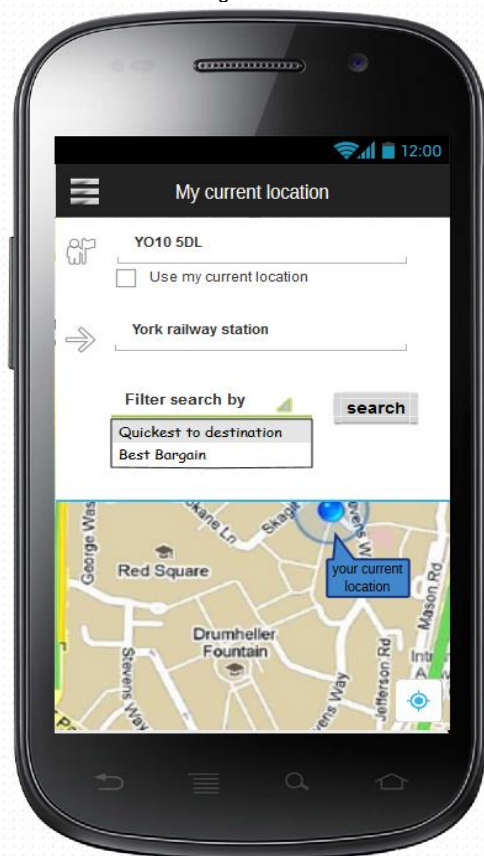


Figure 3.5

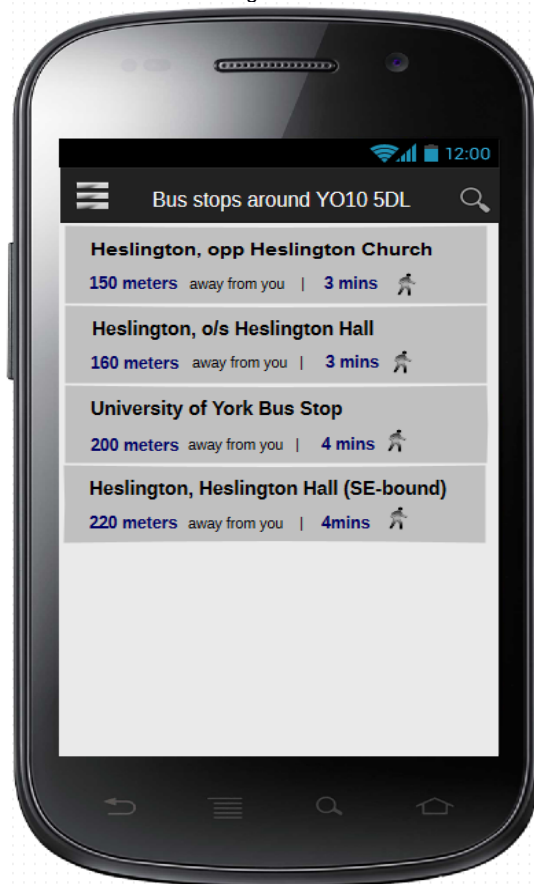


Figure 3.6



Figure 3.7



Figure 3.8



Figure 3.9



Appendix C: User Evaluation Refinement Screenshots

Figure 4.1



Figure 4.2



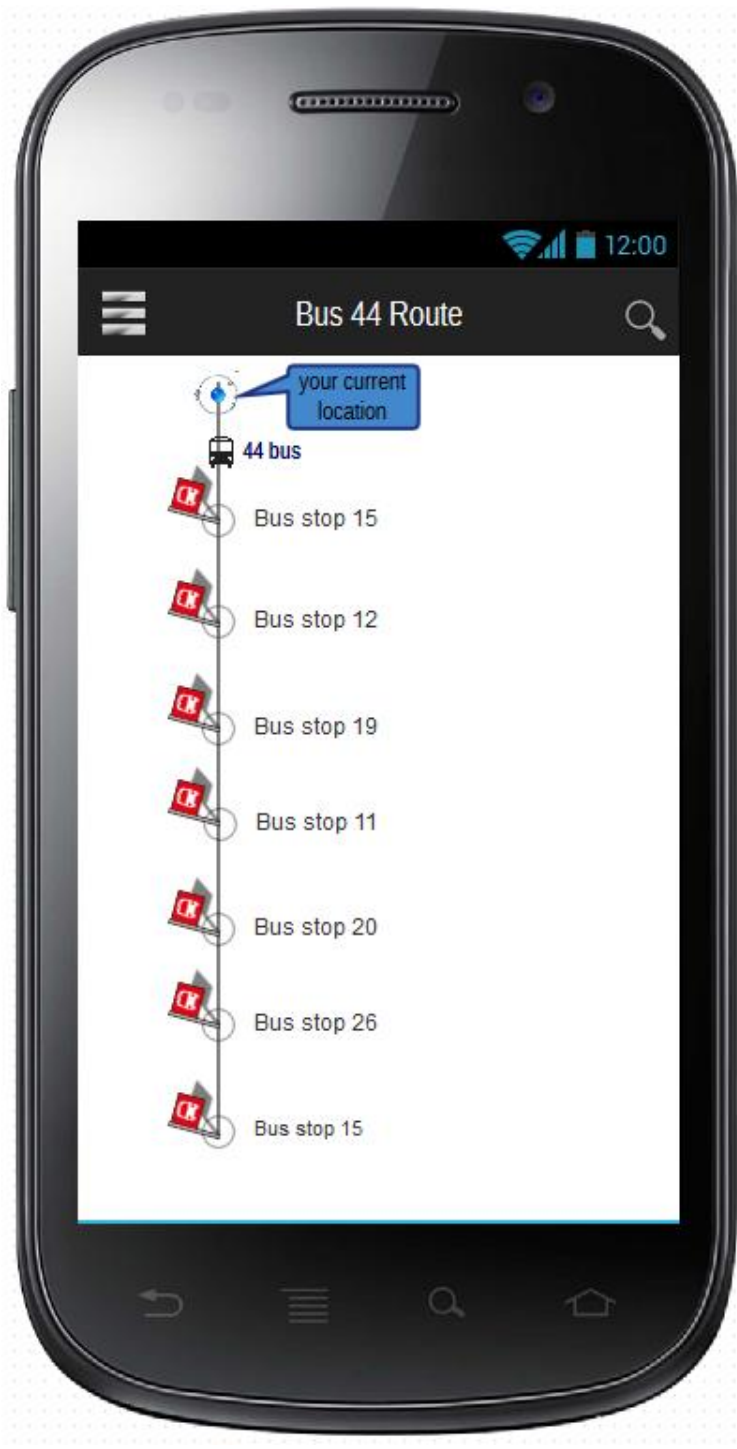
Figure 4.3



Figure 4.4



Figure 4.5



Appendix D: Heuristics Problems

	Problem description	Heuristic Principle	Chukwu diuto Malife	Qiang Huang	Fanlu Hai	Georgios Floros	Averag e
1	Menu page, doesn't indicate which option is currently selected / where the user is.	Visibility of system status & Recognition rather than recall	2	3	4	2	2.75
2	Quickest path menu option, is for a function that is not bus trip relevant but the user doesn't know that at first place. (Context problem)	Recognition rather than recall./Help documentation	1	3	4	3	2.75
3	Title bar text, once a bus stop is chosen, a page containing the buses that will pass through the bus stop shows up, the title only indicates the bus stop name but there are no descriptions to what that page's content are.	Recognition rather than recall.	0	0	1	0	0.25
4	Filtered pages title, when you decide to use a filtered list the title bar doesn't clearly indicate that it is a filtered list.	Recognition rather than recall.	1	2	2	0	1.25
5	Time saving filtered list, difficult to understand how to operate it, it uses many icons but not enough information of what each thing means.	Recognition rather than recall. Help documentation	3	4	4	4	3.75
6	Luggage reminder, no information to what it does.	Help documentation	3	4	4	3	3.5
8	The "Bus stop near you" page, the information of distance is redundant. (The "miles" and "walking time")	Aesthetic and minimalist design	0	1	2	0	0.75
9	The "bus stop A-B" page. In the real world, people need to walk to bus stops and when transfer buses they may need to walk from stop to stop. So the time and route should include the walking and the time needed by walking	Match between system and the real world	4	4	4	4	4
10	Navigation wise, to set a destination you first have to select a filter option, setting 'From' and 'To' should be the shown from the start and be dynamic, so the user can any time at any place in the app change them or see them.	Recognition rather than recall, Match between system and the real world	4	4	4	4	4

Appendix E: User Evaluation Problems

	Problem description	severity
1	The "Bus stops near page" needs more information, including the information of buses.	Minor
2	Landing page, pin point on map isn't self explanatory (the user didn't recognise that he is represented by a pin on the map in the first look.)	Major
3	Many different buses and a bus stop appeared in the the same map, its confusing.	Minor
4	Landing page, options don't look like buttons.	Major
5	Bus Stop specific page, the map of landing page and this page aren't consistent, where the user is is missing.	Major
6	Bus Stop specific page, the options don't look like buttons.	Major
7	Bus route page, don't know where the user is and where the bus is.	Catastrophe
8	Search icon isn't clear enough, had to try it to find out what it does.	Major

Appendix F: Tools Used

- Pencil, <http://pencil.evolus.vn/>
- LibreOffice
- Adobe Photoshop